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AUTHOR Bernard, Donald; And Others
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ABSTRACT

This learning module is designed to enable teachers to help children further develop their concepts of the meaning of numbers in our number system (including concepts of quanity, one-to-one correspondence, number order, before-after, greater than-equal to-less than, number patterns, and the structure of our number system). The module contains a rationale, general objectives, specific objectives, and a list of materials and equipment. There is also a list of general instructions for the teacher or student teacher. The procedures for using the module include a pre-test, a video tape, reading, studying games, several optional activities, and a post-test. A copy of the pre-test and its answer sheet, along with a copy of the post-test and answer sheet, are included. The module also contains games with tri-dominoes. A list of suggested readings and a bibliography complete the module. (RC)

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Number Patterns and Systems

Learning Activity Module IV
Developed for use in Department of Elementary Education
at the University of Florida

EMPORIA KANSAS STATE COLLEGE
TEACHER CORPS
RESOURCE CENTER
ITEM NO. 16
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Dr. Donald Bernard — Director, Mathematics Module Project
Dr. J. J. Shea — Microteaching Laboratory
Dr. Leonard Kaplan — Teacher Corps
Dr. Athol Packer — Teacher Development for Desegregation

College of Education
University of Florida
Gainesville, Florida
32601

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SP009 638

TITLE: NUMBER PATTERNS AND SYSTEMS

RATIONALE: One major change regarding arithmetic content is attention being given to the structure of numbers. Textbook writers now consider a knowledge of the number system to be so important that they give some work on it at each grade level throughout the elementary school. To help reason the "why" of "what is" in our base ten system teachers need to be aware of the various number systems. Likewise, they need to know ways to teach children concepts of: quantity, one-to-one correspondence, number order, before-after, greater than-less than-equal to and recognition of number patterns Teachers also need to be aware of how children develop in their thinking and reasoning of these concepts (especially the work of Piaget on the child's conception of number).

GENERAL OBJECTIVES: To be able to help children develop further their concepts of the meaning of numbers in our number system; including concepts of quantity, one-to-one correspondence, number order, before-after, greater than-equal to-less than, number patterns, and the structure of our number system.

SPECIFIC OBJECTIVES:

1. To be able to identify and give examples of the major classifications of our number system (Natural, Whole, Integer, Rational, Irrational, Real, Imaginary, and Complex).
2. To be able to identify and illustrate one-to-one correspondence with matching, and non-matching sets.
3. To be able to illustrate at least five different patterns for any number larger than three.

4. To be able to explain Piaget's experiment and stages of the child's development in his thinking processes in respect to "Conservation of Numberness."

5. To be able to demonstrate a way a teacher would develop the concept of quantity (e.g. "threeness") with children in the kindergarten or first grade. This would include identifying at least 3 teaching techniques that might be used, 3 teaching aides that would help concretely illustrate the concept of "quantity," and at least 3 different activities that might help children learn this concept.

MATERIALS & EQUIPMENT:

1. Learning Activity Module, NUMBER PATTERNS AND SYSTEMS.
2. Demonstration Classroom tape, NUMBER PATTERNS AND SYSTEMS
3. Video Tape Recorder (audio optional)
4. Any one or more of the resource texts listed in the reading section of the procedures and identified in the resources bibliography. (Texts are available for loan in the library.)

OPTIONAL MATERIALS:

5. Film strip - "Thinking About Four" - by Martha Reihard and Nancy Peterson
6. Filmstrip Projector (Standard)
7. Super 8mm single concept film loop projector.
8. Super 8mm film loops:

   One-to-one #S-80161

   Inequalities #S-80086 — Encyclopedia Britannica Educational Corporation

9. Audio tapes: Imperial Primary Math Skills Improvement Tapes: Lessons 16 and 17 Equalities and Inequalities

GENERAL INSTRUCTIONS TO PARTICIPANTS

This Module is designed to be used by one teacher or student teacher (the participant) working independently. This may take place as part of a workshop or class with two or more participants working together. You may also work on your own.

At times, the procedures will refer to a leader or director. This would be someone from whom you can get help and feedback while you are working on the module or after it has been completed. (This person may be a college methods teacher, a workshop leader, a principal or curriculum director, another teacher or another participant who is familiar with the material you are working on.) Completion of a Module may require an observer to view the participant's video tapes and discuss and/or give feedback to the participant. To complete the module follow the procedures on the next page.

Module IV NUMBER PATTERNS AND SYSTEMS

PROCEDURES

1. PRE-TEST Obtain Pre-Test IV from your leader, or use a separate sheet of paper for your answer sheet and turn to the Pre-Test on page 7 of this module. Take and score the Pre-Test. The answers are found on page 8 of this booklet. Give yourself points as follows:

    1. 1 @ letter = 5 points
    2. 1 @ letter = 7 points
    3. 1 @ criteria = 3 points
    4. 1 @ pattern = 4 points
    5. Subjective Judgment 3 points total
    6. Subjective Judgment 5 points total

        (If your teacher or helper is available ask them to judge 5 and 6 for you.)

    Total - 27 points possible

    If you score 22 or higher you may skip Module IV. Go on to Module V. If not, complete the following instructions:

2. VIDEO: View Video Tape IV, Number Patterns and Systems.

3. READ: Choose one or more of the following:

    Collier and Lerch (1) - pages 47 - 53

    Copeland (2) - pages 57 - 67

    Copeland (3) - pages 14-17, 25-26, 20, 21, and Chapter 14, pages 223-232

    D'Augustine (4) - pages 31-52

    Kennedy (8) - pages 6-8, 30-32, 40-42

Marks (9) - pages 57-58, 63-65, 70

Olson. (11) - pages 8-11

Shipp and Adams (13) - pages 77-83, Chapter 6, pages 149-188

4. GAME: Tri-dominoes - study the games listed on page 12 of this module and play out the games suggested with the set of tri-dominoes included in the envelope on the last page of this module. Teach one of the games to a small group of children (or play it with other module participants in simulation).

5. OPTIONAL ACTIVITIES:

   A. Filmstrip: View "Thinking about Four" by Martha Reihard and Nancy Peterson.

   B. Pattern Cards: Make your own set of pattern cards that can be used with your children.

   C. Tri-dominoes: Make your own set of tri-dominoes, following the pattern included with the game section of this module.

   D. Film Loop: View the 8mm film loops 1) One-to-One (Encyclopedia Britannica Educational Corporation #S-80161). Study the guide that comes with the film loop. Concepts: One-to-one correspondence is a more basic idea in mathematics than counting, and patterns in numbers. 2) Inequalities #S-80086

   E. Audio Tapes: Select the Imperial Primary Math Skills Improvement tape lessons 16 and 17 on Equalities and Inequalities. These tapes are for your children but you should be familiar with their content and method of presentation. Review the Teacher's Manual and the child's worksheet that corresponds to the tape, listen to the tape and complete the exercises suggested.

6. POST-TEST Turn to the post-test section of the module, page 9 . Take the post-test IV like you took the pre-test. Check your own post-test with the answers given on page 11 . Score yourself the same way you did for the pre-test. If you score 22 or higher, go on to Module V. If not, review the video tape for the concepts, information, or skills you are not yet sure of on the post-test. Also, choose another selection from the list of optional readings. Then try the post-test again (or an alternate post-test, if available from your leader). If you do not pass it this time, set up a conference with your leader.

Pre-test IV

Number Patterns and Systems

1. Which of the following diagrams represents one-to-one correspondence?

a) {X, X, X X}
{0 0 0}

b) {X, X, X, X}
{+, +, +, +}

c) {4, 2, 1, 3}
{a, b, c, d}

d) {1, 2, 3,...}
{1, 2, 3}

e) {0, 0, 0, 0}
{Δ, Δ, Δ, Δ}

2. Match the Number System with the example.

_____ a. Whole Numbers
_____ b. Integers
_____ c. Real Number System
_____ d. Imaginary Numbers
_____ e. Rational Numbers
_____ f. Irrational Numbers
_____ g. Natural Numbers

t. all fractions that have a terminating or repeating decimal equivalent.
u. 1, 2, 3,...
v. 0, 1, 2, 3,...
w. includes rational and irrational no's.
x. all numbers that produce a non-terminating non-repeating decimal.
y. ..., -3, -2, -1, 0, +1, +2,...
z. $\sqrt{-1}$

3. Make up a drawing of a sample problem that would help primary level children use: one-to-one correspondence, identify which of the two groups is greater than the other, and could answer your question "How much greater?"

4. Draw 4 <u>different</u> patterns of 5 dots. (Make sure one pattern is not just another pattern turned around.)

5. Explain Piaget's experiment on concept development in "Conservation of Number."

6. Teaching Problem: Can you explain how you as a teacher would develop the concept of quantity (for example "fiveness") with children in kindergarten or first grade. What teaching techniques would be used with the teaching aides you would employ? Do not make a list, rather explain in essay form how you would teach a concept, step by step.

ANSWER SHEET FOR PRE-TEST IV

NUMBER PATTERNS AND SYSTEMS

1. C

2. A. - V
   B. - Y
   C. - W
   D. - Z
   E. - T
   F. - X
   G. - U

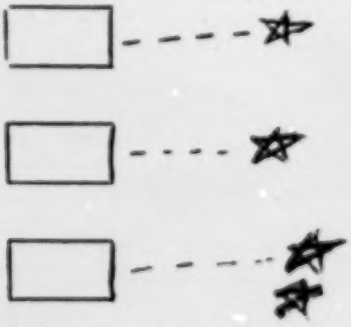
3. Any drawing that includes:

   A. At least two groups of objects

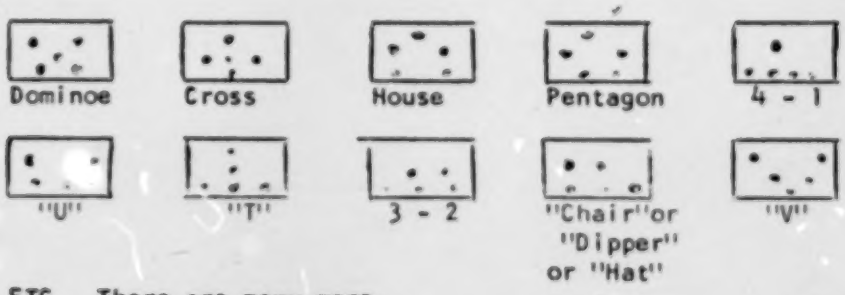
   B. Lines drawn from each object in one group to an object in the second group.

   C. If they are not equal groups it is obvious that one or more objects have no partner in the other group.

   E.G.



4. Here are 10 possible answers:



   ETC. There are many more.

5. Conservation of Number - The idea of relation is important. Some of the first experiences in mathematics for children involve the comparison or relation of two quantities. Are they "the same as" or "equal" or is one "greater" than the other or "smaller" than the other? In this activity the child is asked these questions for different arrangements of two equal groups of blocks to determine if he understands the quantitative relation separate from the group's spacial arrangement.

6. Review tape for answer.

Post-test IV

Number Patterns and Systems

1. Which of the following diagrams represents one-to-one correspondence?

a.) x, x, x
0, 0, 0, 0

b.) +, +, +, +
x, x, x, x

c.) 1, 2, 4
1, 2, 4,...

d.) 5, 3, 1, 7
X, Z, W, Y

e.) 0, 0, 0, 0
△, △, △, △

2. Draw 4 <u>different</u> patterns of 6 dots. (Make sure one pattern is not just another pattern turned around).

3. Match the Number System with the example.

_____ a. Imaginary Numbers
_____ b. Integers
_____ c. Irrational Numbers
_____ d. Natural Numbers
_____ e. Rational Numbers
_____ f. Real Numbers
_____ g. Whole Numbers

t. all fractions that have a terminating or a repeating decimal equivalent.
u. 1, 2, 3,...
v. 0, 1, 2, 3,...
w. include rational and irrational numbers
x. all numbers that produce a non-terminating non-repeating decimal.
y. .., -3, -2, -1, 0, +1, +2,...
z. $\sqrt{-1}$

4. Make up a drawing of a sample problem that would help primary level children use: one-to-one correspondence, identify which of the two groups is less than the other, and could answer your question "How much less?"

5. Explain Piaget's experiment on concept development in "Conservation of Number."

6. Teaching Problem: Explain how you as a teacher would develop the concept of quantity (for example "fourness") with children in kindergarten or first grade. What teaching techniques would be used with the teaching aids you would employ? Don't make a lis , but rather explain in essay form how you would teach the concept, step by step.

Answer Sheet for Post-Test IV

NUMBER PATTERNS AND SYSTEMS

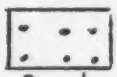
1. D

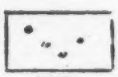
2. Here are 10 possible answers. There are many more.

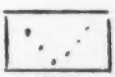
"Dominoe"

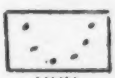
"T"

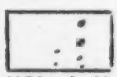
"X"

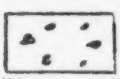

2 - 4

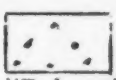

"Y"


"V"


"U"


"Chair" or
"dipper" or "hat"


"Hexagon"


"Triangle"

3. a. z d. u g. v

   b. y e. t

   c. x f. w

4. Any drawing that includes:

   A. At least two groups of objects

   B. Lines drawn from each object in one group to an object in the second group.

   C. If they are not equal groups it is obvious that one or more objects have no partner in the other group.

   E.G.

5. Conservation of Number - The idea of Relation is important. Some of the first experiences in mathematics for children involve the comparison or relation of two quantities. Are they "the same as" or "Equal" or is one "greater" than the other or "smaller" than the other? In this activity the child is asked these questions for different arrangements of two equal groups of blocks to determine if he understands the quantitative relation separate from the group's spacial arrangement.

6. Review tape for answer.

Games to Play with Tri-Dominoes

Game 1. Match the Dots (One-to-One Correspondence)

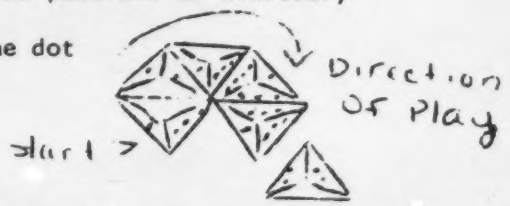
Object: Match the dots on the last tri-dominoe played. First person to use up all his tri-dominoes wins. (Goes out first.)

Start: Turn all tri-dominoes face down. Each player draws five, laying them face up in front of him. Person with lowest total of dots on any one of the tri-dominoes is first.

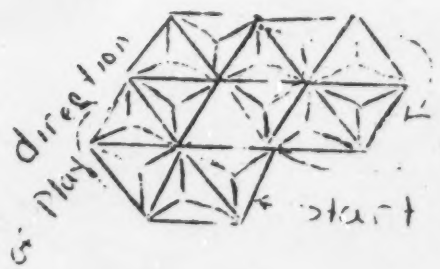
Play: Player to the left plays next, matching one side of the last played tri-dominoe with one of his. The next person on the left plays on the last played tri-dominoe, etc.

Bone Pile: If a player cannot match on his turn, he must take new tri-dominoes from the bone pile (the remaining undrawn face down pieces) until he does make a match or until the pile is empty. If he still cannot play he loses his turn to the next player.

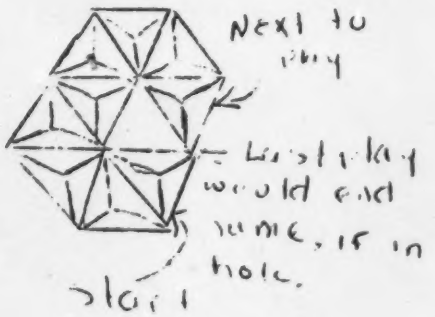
Matching Two Sides: Sometimes it may be possible or necessary to match two tri-dominoes with one. For example: If a player had a tri-dominoe which matched the one dot of the last played piece he would also need to match the two dots of the starting piece in order to play his piece in the space shown. Otherwise, he can only play on the four-dot side.



Holes - (Matching All Three Sides): Two other ways to end the game without going out may occur if holes are created in the pattern of the tri-dominoes as illustrated below. Player with the fewest number of tri-dominoes left in his hand is the winner.



Last played piece if hole would be filled



Game 2. Make Four (Simple addition Combinations thru 4+4)

Object: Add combinations of dots to make a sum of four. First one who goes out wins.

Start: Same as in game number one above.

Play: Instead of matching dots, face together dots whose sums equals four: blank with four dots, three with one, two plus two. If a combination of four cannot be made the player must draw from the bone pile as in game one. A play can be made as long as a player can get a sum of four on one side of the tri-dominoe even if he places his piece next to two tri-dominoes or in a hole (three tri-dominoes).

Strategy: If you have a choice of pieces to play, look ahead to your left to see which one would be less advantageous for your opponent to play on. Can you make him dig in the bone pile?

Game 3. Addition (Addition and Subtraction thru two figures)

Objective: Have highest total of points from adding combinations of dots.

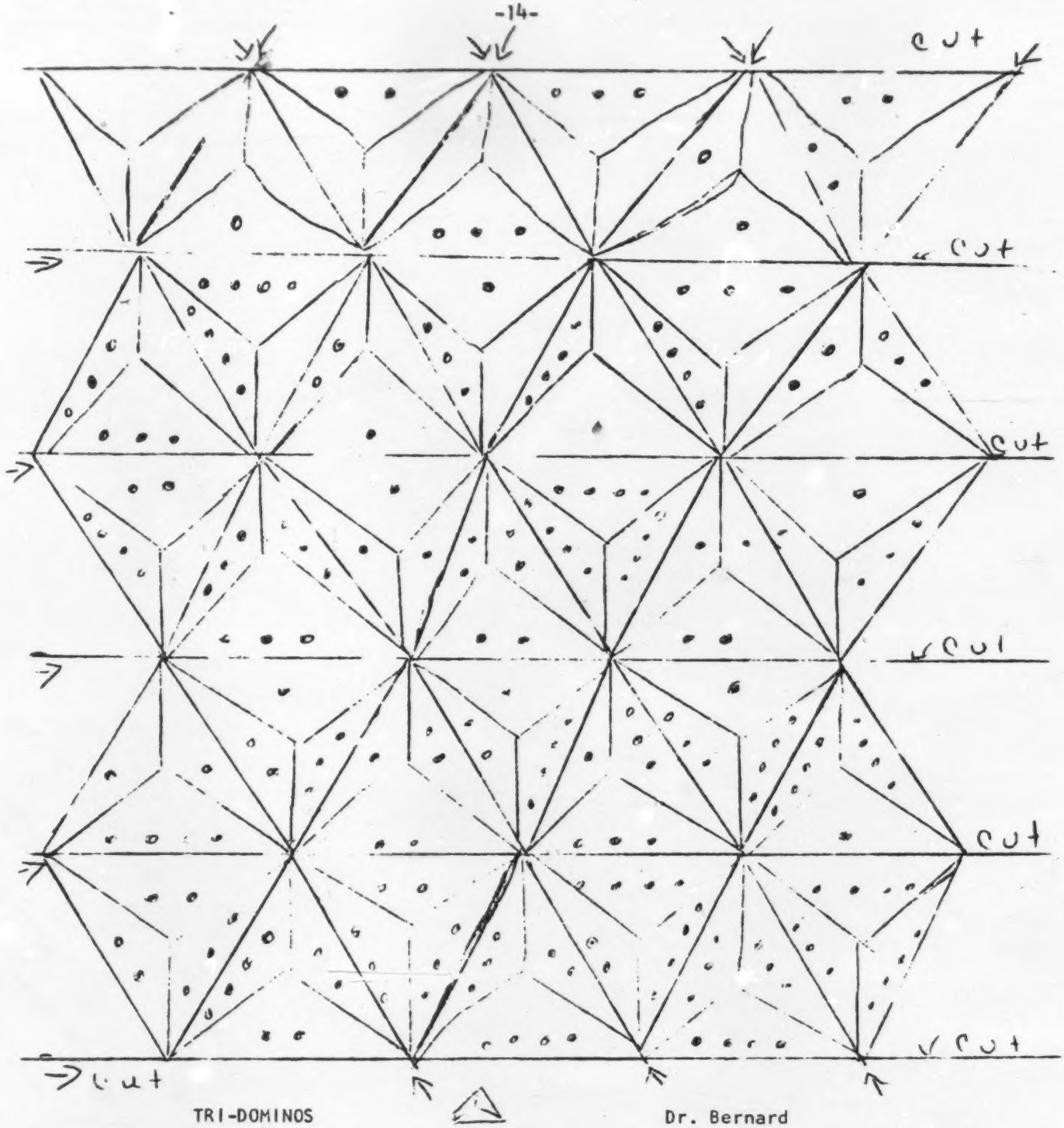
Start: Same as in game two.

Play: With each new game players take turns in starting. First player draws an extra tri-dominoe from the bone pile, places it face up in the center of the playing area, and begins his first play on it. Any tri-dominoe can be played on the last one played. When play is made the points on the matching sides are added, eg. 3+1, 4+3, etc. With the highest addition 4+4. (Lowest 0+0) Scores are kept for each player and added with each turn. When someone goes out the game is over, person with the highest score is the winner.

Options: Player may choose to draw from bone pile as many times as he wishes for a higher possible piece instead of playing one from his hand. However, when another player goes out, each remaining player loses 5 points for each piece he has not played.

Bonus Option: The player who goes out get a pre-determined number of points for going out. (Usually not more than 10.)

CAN YOU THINK OF OTHER GAMES YOU CAN PLAY WITH TRI-DOMINOES THAT GIVE PRACTICE IN MATHEMATICAL SKILLS?



TRI-DOMINOS

Dr. Bernard

SUGGESTED READINGS OF CONTENT TEXTS ON UNDERSTANDING NEW MATH CONCEPTS (NOT ON "HOW TO TEACH")

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